



A.D. 1867, 7th NOVEMBER. N° 3139.

S P E C I F I C A T I O N

OF

THOMAS ROTHWELL BARDSLEY
AND
WILLIAM BLACKSHAW.

SMOKE-CONSUMING FURNACES.

LONDON:

PRINTED BY GEORGE E. EYRE AND WILLIAM SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY:

PUBLISHED AT THE GREAT SEAL PATENT OFFICE
25, SOUTHAMPTON BUILDINGS, HOLBORN.

Price 8d.

1868.



A.D. 1867, 7th *NOVEMBER*. N° 3139.

Smoke-consuming Furnaces.

LETTERS PATENT to Thomas Rothwell Bardsley, of the City of Manchester, Watchman, and William Blackshaw, of Manchester, aforesaid, Boot Maker, for the Invention of “**IMPROVEMENTS IN APPARATUS FOR SMOKE-CONSUMING IN STEAM BOILER AND OTHER FURNACES.**”

Sealed the 5th May 1868, and dated the 7th November 1867.

PROVISIONAL SPECIFICATION left by the said Thomas Rothwell Bardsley and William Blackshaw at the Office of the Commissioners of Patents, with their Petition, on the 7th November 1867.

We, THOMAS ROTHWELL BARDSLEY, of the City of Manchester, Watchman, 5 and WILLIAM BLACKSHAW, of Manchester aforesaid, Boot Maker, do hereby declare the nature of the said Invention for “**IMPROVEMENTS IN APPARATUS FOR SMOKE-CONSUMING IN STEAM BOILER AND OTHER FURNACES,**” to be as follows :—

This Invention has for its object the consumption of smoke in steam boiler furnaces by the introduction of heated air at the back of the bridge, which 10 mixing with the smoke is immediately converted into ignited gas, the heat from which is at once communicated to the boiler ; and this Invention consists in the use and application of a tube formed of metal, fire-clay, or other suitable material carried from the rear of the boiler (where a damper may be applied to its end) into the metallic tubular flue, or through the brick flues 15 round the boiler, and thence through the metallic tubular flue, where it may be perforated with small holes and open into a cavity formed at the back of the bridge, which cavity has a narrow opening into the flue at the back of the

Bardsley & Blackshaw's Improvements in Smoke-consuming Furnaces.

bridge, covered with an overhanging top to prevent soot falling into the cavity and thus choking it up. Upright branch pipes may be taken from the main pipe within the tubular flue with their ends bent round in the direction of the draft, and in the front of such branch pipes convex diaphragm plates of a less diameter than the flue may be mounted upon stands or feet resting in the 5 flue, thus reducing the area of the flue, and by their peculiar form causing the admixture of the smoke and heated air to be more perfect.

The action of this apparatus may be thus described:—Atmospheric air is continually passing through the metallic or other tube into the cavity at the back of the bridge, which becoming heated in its passage is in the proper 10 state to be mixed with the smoke in the flues, and thus a smoke-consuming apparatus is constructed which is always in action, and the quantity of air admitted may be regulated by a self-acting damper, so that when the furnaces are freshly fed a greater quantity of air may be supplied, which may again be reduced by self-closing mechanism applied to the damper. 15

It will be readily apparent that these improvements are equally applicable to other furnaces for the consumption of smoke.

SPECIFICATION in pursuance of the conditions of the Letters Patent, filed by the said Thomas Rothwell Bardsley and William Blackshaw in the Great Seal Patent Office on the 7th May 1868. 20

TO ALL TO WHOM THESE PRESENTS SHALL COME, we, THOMAS ROTHWELL BARDSLEY, of the City of Manchester, Watchman, and WILLIAM BLACKSHAW, of Manchester aforesaid, Boot Maker, send greeting.

WHEREAS Her most Excellent Majesty Queen Victoria, by Her Letters Patent, bearing date the Seventh day of November, in the year of 25 our Lord One thousand eight hundred and sixty-eight, in the thirtieth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto us, the said Thomas Rothwell Bardsley and William Blackshaw, Her special licence, that we, the said Thomas Rothwell Bardsley and William Blackshaw, our executors, administrators, and assigns, or such others as we, 30 the said Thomas Rothwell Bardsley and William Blackshaw, our executors, administrators, and assigns, should at any time agree with, and no others, from time to time and at all times thereafter during the term therein expressed, should and lawfully might make, use, exercise, and vend, within the United Kingdom of Great Britain and Ireland, the Channel Islands, and Isle of 35 Man, an Invention for “IMPROVEMENTS IN APPARATUS FOR SMOKE-CONSUMING

Bardsley & Blackshaw's Improvements in Smoke-consuming Furnaces.

IN STEAM BOILER AND OTHER FURNACES," upon the condition (amongst others) that we, the said Thomas Rothwell Bardsley and William Blackshaw, our executors or administrators, by an instrument in writing under our, or their, or one of their hands and seals, should particularly describe and ascertain the
5 nature of the said Invention, and in what manner the same was to be performed, and cause the same to be filed in the Great Seal Patent Office within six calendar months next and immediately after the date of the said Letters Patent.

NOW KNOW YE, that we, the said Thomas Rothwell Bardsley and
10 William Blackshaw, do hereby declare the nature of our said Invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This Invention has for its object the consumption of smoke in steam boiler furnaces by the introduction of heated air at the back of the bridge, which
15 mixing with the smoke is immediately converted into ignited gas, the extra heat thereby produced being at once communicated to the boiler; and this Invention consists in the use and application of a tube formed of metal, fire-clay, or other suitable material carried from the rear of the boiler (where a damper may be applied to its end) into the metallic tubular flue, or through
20 the brick flues round the boiler, and thence through the metallic tubular flue, where it may open into a cavity formed at the back of the bridge, which cavity has a narrow opening into the flue at the back of the bridge, which may or may or may not be covered with an overhanging top to prevent soot falling into the cavity and thus choking it up.

25 The action of this apparatus may be thus described:—By means of the draught in the flues atmospheric air is caused to pass through the metallic or other tube into the cavity at the back of the bridge, which becoming heated and rarified in its passage is in the proper state to be mixed with the smoke in the flues, and the quantity of air admitted may be regulated by a self-acting
30 damper, so that when the furnaces are freshly fed a greater quantity of air may be supplied, which may again be reduced gradually until entirely cut off by self-closing mechanism applied to the damper.

It will be readily apparent that these improvements are equally applicable to other furnaces for the consumption of smoke.

35 That this our said Invention may be the more readily seen and understood, we have hereunto annexed a Sheet of Drawings illustrative of two modifications of our improvements in apparatus for smoke-consuming in steam boiler furnaces. Similar letters marked on the Drawings are used to denote similar parts in all the views.

Bardsley & Blackshaw's Improvements in Smoke-consuming Furnaces.

Fig. 1 is a front view partially in section, Fig. 2 a longitudinal section, and Fig. 3 is a plan of a double-flued steam boiler shewing one modification of our improved apparatus applied thereto, drawn to a scale of about three-eighths of an inch to a foot; Fig. 4 is an exterior front view, Fig. 5 a side sectional view, and Fig. 6 a plan of the self-acting arrangement for closing the damper 5 for cutting off the supply of atmospheric air to our smoke-consuming apparatus.

And Fig. 7 is a side sectional view of a modification of such self-acting mechanism, drawn to a scale of about two inches to the foot.

Fig. 8 is a sectional front view, and Fig. 9 is a side sectional view of a steam boiler furnace, shewing another modification of our improvements in 10 apparatus for smoke consuming, drawn to a scale of about three-quarters of an inch to a foot.

In Figs. 1, 2, 3, 4, 5, and 6, A represents the tubular flues of the boiler; B, the furnaces; C, the furnace doors; and D, the bridges. In each of the tubular flues E is an air supply pipe carried from the rear of the boiler, being 15 open to the atmosphere at the extremity marked F, and communicating with the hollow chamber or nozzle G placed at the back of the bridge, such chamber or nozzle being constructed with a narrow mouth H opening into and extending from one side of the flue to the other (as seen in plan), and situated by preference a little below the top surface or edge of the bridge D, 20 as illustrated in Fig. 2. The mouth or extremity F of the air supply pipe E is arranged to be closed by self-acting mechanism, an enlarged view of which is seen in Figs. 4, 5, and 6, consisting of an outer cylinder I containing water, in which is partially immersed an inner cylinder K on the ordinary gasometer principle, such inner cylinder having guide rods L affixed to its upper end, 25 which slide in holes formed in the lugs M projecting from the outside of the outer cylinder, and a disc N is affixed to the lower extremities of such guide rods, which disc when in close contact with the flange O of the air supply pipe E effectually closes the mouth F of the air supply pipe E.

In the modification of self-acting closing mechanism represented by Fig. 7 the 30 outer and inner cylinders and disc are the same as in Figs. 4, 5, and 6, and are distinguished by the same letters of reference, but the outside guide rods L are dispensed with, and a single rod P situated in the centre of both cylinders is substituted, being affixed at its upper extremity to the top of the inner cylinder, and surrounded by an outer tube Q, which slides over an inner 35 tube R rising from the bottom and forming part of the outer cylinder, so that together the two tubes constitute an air-tight slide for the rod P, which works up and down the inside of the inner tube R, and has the disc N attached to its lower extremity. The inner cylinders of both modifications of such closing

Bardsley & Blackshaw's Improvements in Smoke-consuming Furnaces.

mechanism is attached to one end of a chain S, which after passing over the pulley T is affixed to the wheel U mounted upon the rod V, which is an extension of the furnace door hinge pin, and consequently partially turns round as the furnace door opens. W is a cock situated upon the top of the
5 inner cylinder, which regulates its fall, as herein-after described.

The action of this apparatus is as follows :—In the act of opening one of the furnace doors C to supply fresh fuel to either of the furnaces B the inner cylinder K is lifted bodily out of the water by the chain S becoming partially wound round the wheel U, and such cylinder immediately becomes filled with
10 air; at the same time the disc N attached to the guide rod or rods of such inner cylinder is also raised so as to open the mouth of the pipe E, when the draught in the flues causes the atmospheric air to enter into the air supply pipe E, which in passing through into the nozzle G becomes heated to a high temperature, and in such state enters the flue at the back of the bridge
15 through the opening H at a point where the smoke impinges upon the top of the bridge, and there mixing with such smoke turns it into ignited gas, the extra heat from which is at once communicated to the boiler inside the internal flue. The furnace door being closed again, such is the peculiar action of the self-closing mechanism that the chain S is left slack by the inner
20 cylinder K falling on to the surface of the water contained in the outer cylinder I, into which it gradually sinks according to the speed at which the air contained in it is allowed to escape through the cock W, which can be regulated by opening or closing such cock to take place in two, three, four, or more minutes; and it is only when the inner cylinder K has fallen to the
25 bottom of the outer cylinder I that the disc N is in close contact with the flange O and the supply of air cut off. It will thus be apparent that this Invention aims more particularly at consuming the large volumes of black smoke which are evolved when the furnaces are freshly fed with fuel, at which time the greatest waste ordinarily takes place, and that as the smoke is
30 converted into ignited gas without any cost inside the internal flues, that a greater effect must necessarily be produced from a given quantity of fuel than would be the case if the smoke had been allowed to escape unconsumed into the chimney shaft, and therefore we say that our Invention not only obviates the nuisance and waste arising from the production of smoke, but economises
35 fuel at the same time, and this without requiring any attention at the fireman's hands, as the regulating cock W being once set need not be touched afterwards. By preference we construct the air supply pipe E of cast iron, but it might be made of fire-clay, plumbago, or any other suitable material, and we prefer to employ as large a diameter of pipe as the flues will allow

Bardsley & Blackshaw's Improvements in Smoke-consuming Furnaces.

consistent with not interfering with the draught, say, from six to eight inches internal diameter, and in short tubular boilers we pass such pipe through the side flues, as well as through the internal metallic flue, in order to communicate the highest possible temperature to the air before mixing it with the smoke. In some situations, where the size of the flues precludes the possibility of using an air supply pipe of sufficiently large diameter to consume the smoke, we prefer to use the modification illustrated in Figs. 8 and 9, which only differs from the foregoing in dispensing with the ordinary fire-brick bridge and bringing the nozzle *a* into almost close contact with the end of the fire-bars *b*, and in the application of grated bars *c*, which are curved (as seen in Fig. 9) so as to bend over the mouth of the nozzle *a*, and thus prevent any tendency in firing to choke up the mouth of such nozzle, whilst the space *d* left between the rear of such curved bars *c* and the nozzle *a* allows a small quantity of air to pass between such bars and over the nozzle (which in this modification forms the bridge), and thus serve the double purpose of preventing injury to such bars and nozzle, owing to the great heat to which they are subjected, and at the same time materially assists the combustion of the smoke in conjunction with the heated air, which is supplied according to the modification illustrated by Figs. 1, 2, and 3.

We would here remark that our improved apparatus is equally applicable for single or double flued as well as to multitubular boilers, and to boilers which are fired externally.

Having thus particularly described and ascertained the nature of this our said Invention, together with the best methods with which we are acquainted for carrying the same into practical effect, we wish it to be distinctly understood that we do not confine ourselves to the precise details, relative proportions, or dimensions of the several parts or portions of our improved apparatus, as the same may be considerably varied without departing from the Invention; but what we do claim is,—

First. The general arrangement and combination of the various parts of the smoke-consuming apparatus consisting of a pipe carried through the flues of a steam boiler from the rear of a boiler to a chamber at the back of the bridge, through which pipe a continuous current of air is drawn, so long as it is required, by the simple action of the draught in the flues, which is heated in passing through before mixing with the smoke, in conjunction with the curved bars illustrated in Figs. 8 and 9, applied as and for the purpose hereinbefore described and illustrated in the accompanying Drawings, or any mere modification of the same.

Secondly and lastly. The self-closing mechanism for cutting off a supply of

Bardsley & Blackshaw's Improvements in Smoke-consuming Furnaces.

atmospheric air gradually, and capable of being regulated for smoke-consuming purposes, as herein-before described and illustrated in the accompanying Drawings, or any mere modification of the same.

5 In witness whereof, I, the said Thomas Rothwell Bardsley, for and on behalf of myself and the said William Blackshaw, have hereunto set my hand and affixed my seal, this Sixth day of May, in the year of our Lord One thousand eight hundred and sixty-eight.

THOMAS ROTHWELL BARDSLEY. (L.S.)

Witness,

10 JOHN G. WILSON,

Patent Agent,

1, Market Place,

Manchester.

LONDON:

Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty. 1868.

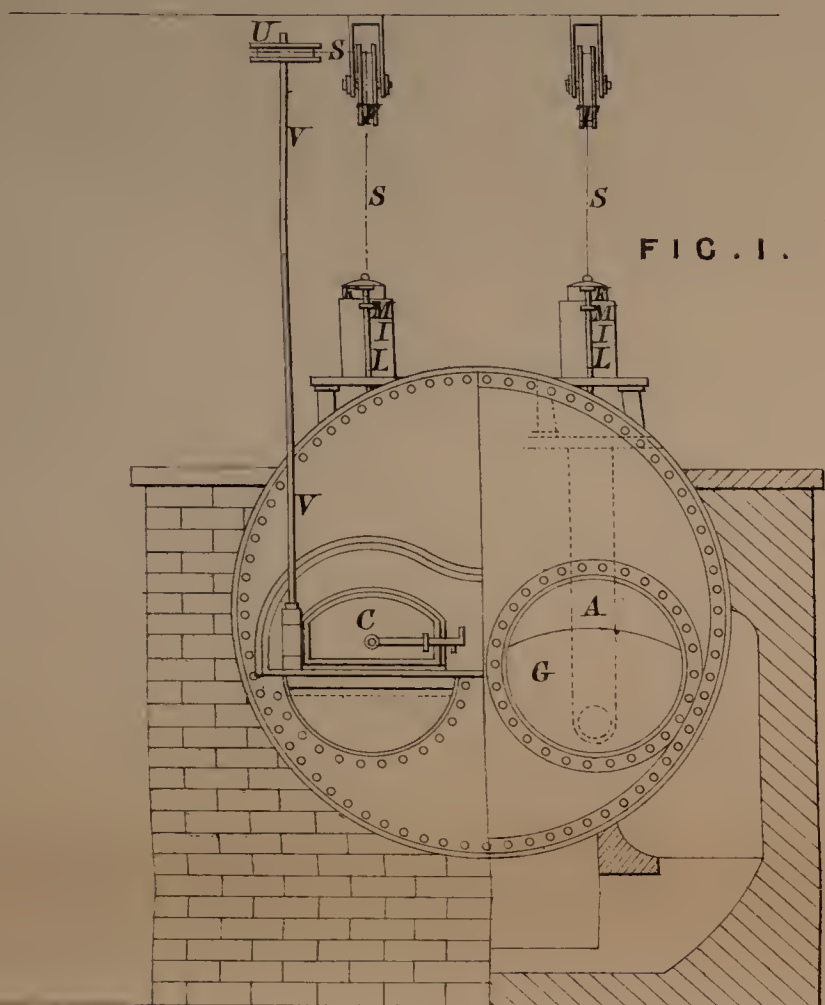


FIG. 1.

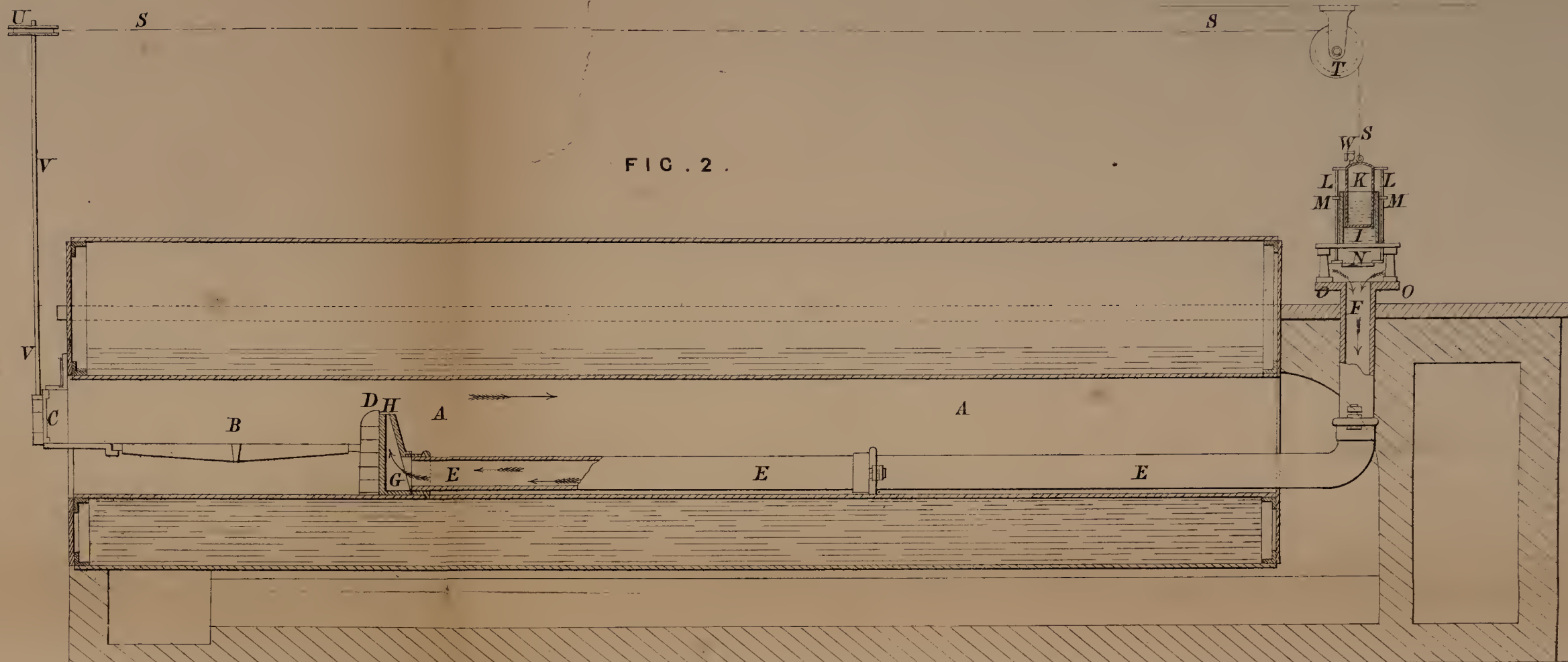


FIG. 2.

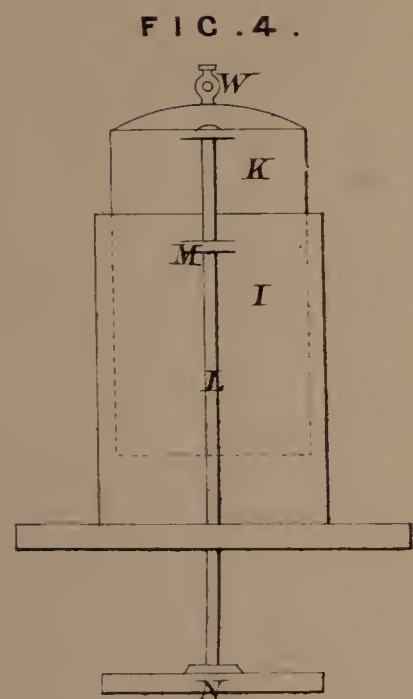


FIG. 4.

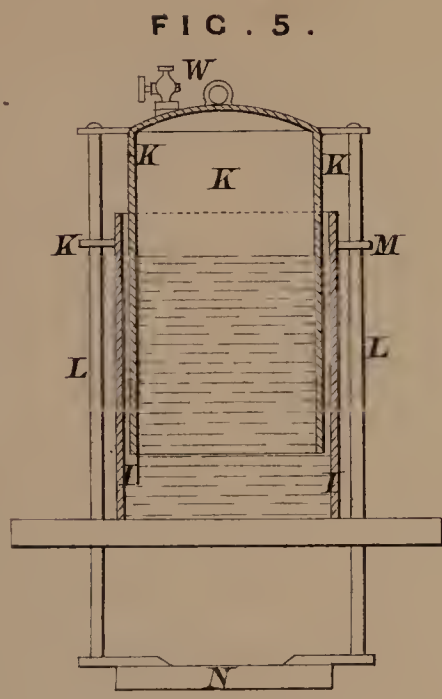


FIG. 5.

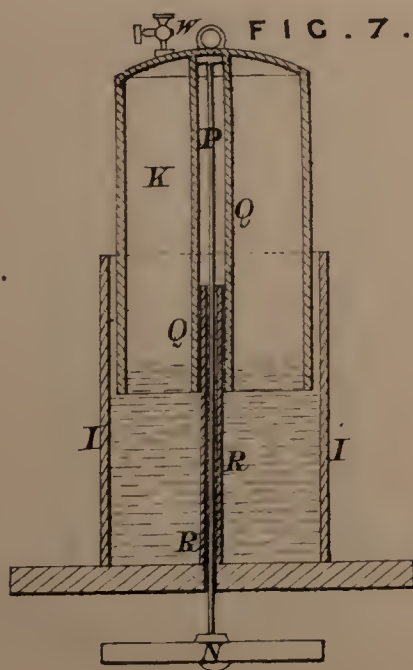


FIG. 7.

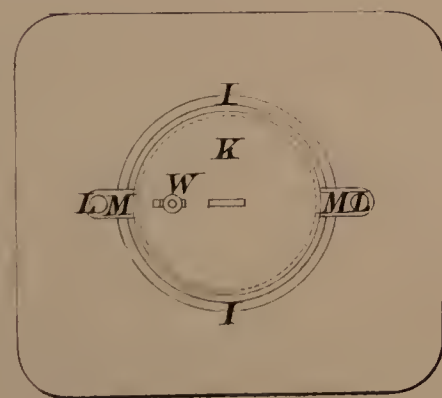


FIG. 6.

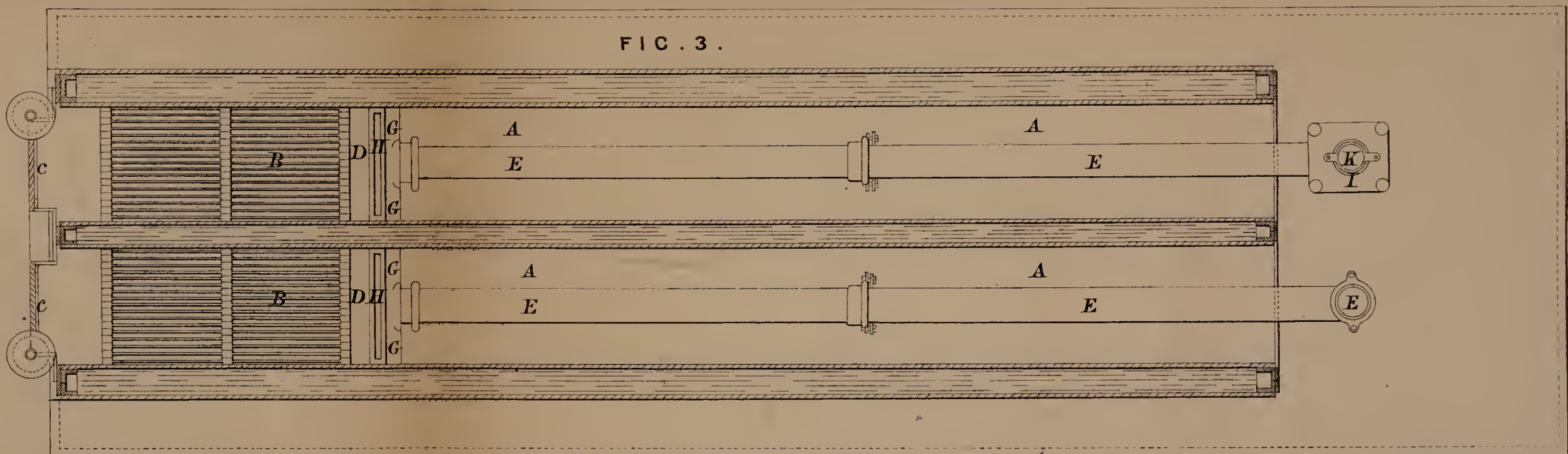


FIG. 3.

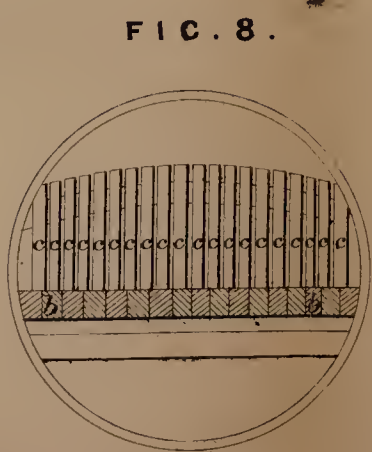


FIG. 8.

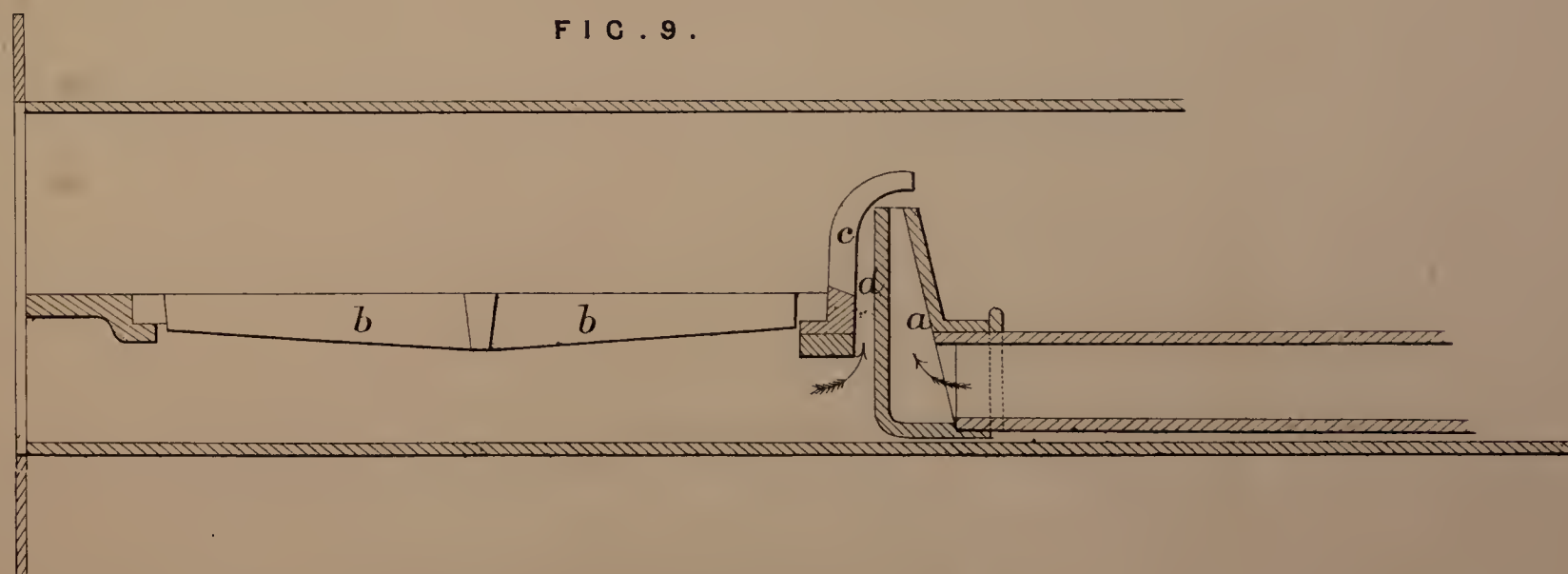


FIG. 9.

